SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

PUBLISHED AT
TRIBUNE BUILDING, NEW YORK.

P. O. Box 3838.

SATURDAY, JULY 16, 1881.

We are indebted to Professor Edward S. Holden for a series of seven interesting drawings of the recently discovered Comet; they are now being engraved and will appear in "SCIENCE" next week.

These drawings were made by Professor Holden from observations made with the 15-inch equatorial of the Washburn Observatory.

We have received a copy of the instructions furnished to the officers in command of the expeditionary force to Lady Franklin Bay, which appear to have given general satisfaction, and probably suffice for all the purposes of the expedition. Still we regret to find that the services of a naturalist have not been considered requisite, and that no provision appears to have been made for collecting specimens and information respecting the Fauna and Flora of the Polar regions. A microscope is not even added to the list of apparatus provided for the use of the expedition.

Mr. Alfred Russell Wallace in his last work, "Island Life," observes that there is an enormous waste of labor and money with comparatively scanty and unimportant results to natural history, of most of the great scientific voyages of the various civilized governments during the present century. All these expeditions combined have done far less than private collectors in making known the products of remote lands and islands. They have brought home, he asserts, fragmentary collections, made in widely scattered localities and these have been usually described in huge folios, whose value is often in inverse proportion to their bulk and cost. The same species have been collected again and again, often described several times, and, not infrequently stated to be from places they never inhabited. The result of this wretched system, says Mr. Wallace, is, that the productions of some of the most frequently visited and most interesting islands on the globe are still very imperfectly known, while their native plants and animals are being yearly exterminated. The remedy suggested by Mr. Wallace, is that resident naturalists at a very small annual expense, should be appointed, who, he considers, would do more for the advancement of knowledge in this direction, than all the expensive expeditions which have again and again circumnavigated the globe.

We are of course aware that most of the many recent expeditions to the polar regions have been specially organized for the promotion of the physical sciences, but the value of an expert naturalist on such occasions should not be neglected, and wherever permanent stations are established the naturalist may be expected to do good work, and even occasionally interpret natural phenomena which are sometimes inexplicable to the physicist.

The comet has been observed here (with the exception of June 27) on every night since June 23, although clouds have often considerably hindered the work.

In addition to the measurements of position, the light of different parts of the comet has been photometrically determined. This work, very probably, has been undertaken only at this Observatory. The instrument employed for the purpose is one which has already been extensively used here for measuring the light of nebulæ. The results of these observations are expressed in stellar magnitudes on Pogson's logarithmic scale, regarding the light of a star of the given magnitude as diffused over a circle 1′ in diameter, the brightness of which would then be equal to that of the observed portion of the nebula or comet. On the first five nights of the present month, various parts of the coma and tail have thus been observed. The result, from a provisional reduction, is as follows:

Coma,	0.′5	south of	nucleus,	magnitude	6.9
"	0.′5	north of	"	"	7.8
Tail,	0.°5	"	"	"	9.6
"	1.°0	"	"	"	10.3
"	2.°0	"	"	"	11.0
"	3.°0	"	"	"	11.2
"	4.°0	"	"	"	11.6

I add the corresponding results, also from provisional reductions, for some other comets and nebulæ:

Palisa's Comet, 1879 *d*.	magnitude	8
Comet, 1880 *d*.	"	7
Webb's Planetary Nebula, DM. + 41°4004	"	4.7
Brightest part of great nebula in Orion (20 points in which have been observed),	"	8.0
Nebula G. C. 4487,	"	11.2
" G. C. 4802,	"	11.3

On June 28th, and on July 1, 3, 5 and 6, the coordinates of a number of points in the border of the comet's tail were observed for the purpose of determining its form.

EDWARD C. PICKERING.

HARVARD COLLEGE OBSERVATORY,
Cambridge, U. S., *July 6th*, 1881.

THE UNITY OF NATURE.

By the Duke of Argyll.

IX.

THE ORIGIN OF RELIGION CONSIDERED IN THE LIGHT OF THE UNITY OF NATURE.

(Continued.)

The considerations set forth in the previous chapter indicate the fallacies which lie in our way when we endeavor to collect from the worship of savage nations any secure conclusions as to the origin of Religion. Upon these fallacies, and upon no more safe foundation, Comte built up his famous generalization of the four necessary stages in the history of Religion. First came Fetishism, then Polytheism, and then Monotheism, and last and latest, the heir of all ages, Comtism itself, or the Religion of Humanity, which is to be the worship of the future.

Professor Max Müller has done admirable service in the analysis and in the exposure which he has given us of the origin and use of the word "Fetishism," and of the theory which represents it as a necessary stage in the development of Religion.[1] It turns out that the word itself and the fundamental idea it embodies, is a word and an idea derived from one of those popular superstitions which are so common in connection with Latin Christianity. The Portuguese sailors who first explored the West Coast of Africa were themselves accustomed to attach superstitious value to beads, or crosses, or images, or charms and amulets of their own. These were called "feticos." They saw the negroes attaching some similar value to various objects of a similar kind, and these Portuguese sailors therefore described the negro worship as the worship of "feticos." President de Brosses, a French philosopher of the Voltairean epoch in literature, then extended the term Fetish so as to include not only artificial articles, but also such great natural features as trees, mountains, rivers and animals. In this way he was enabled to classify together under one indiscriminate appellation many different kinds of worship and many different stages in the history of religious development or decay. This is an excellent example of the crude theories and false generalizations which have been prevalent on the subject of the origin of Religion. First, there is the assumption that whatever is lowest in savagery must have been primeval—an assumption which, as we have seen, is in all cases improbable, and in many cases must necessarily be false. Next there is great carelessness in ascertaining what is really true even of existing savages in respect to their religious beliefs. It has now been clearly ascertained, that those very African negroes whose superstitious worship of material articles supposed to have some mysterious powers or virtues, is most degraded, do nevertheless retain behind and above this worship certain beliefs as to the nature of the Godhead, which are almost as far above their own abject superstitions as the theology of a Fénélon is above the superstitions of an ignorant Roman Catholic peasant. It is found that some African tribes have retained their belief in one Supreme Being, the Creator of the world, and the circumstance that nevertheless no worship may be addressed to Him has received from Professor Max Müller an explanation which is ample. "It may arise from an excess of reverence quite as much as from negligence. Thus the Odjis or Cohantis call the Supreme Being by the same name as the sky; but they mean by it a Personal God, who, as they say, created all things and is the Giver of all good things. But though He is omnipresent and omniscient, knowing even the thoughts of men, and pitying them in their distress, the government of the world is, as they believe, deputed by Him to inferior spirits, and among these, again, it is the malevolent spirits only who require worship and sacrifice from man."[2] And this is by no means a solitary case. There are many others in which the investigations of missionaries respecting the religious conceptions of savage nations have revealed the fact that they have a much higher theology than is indicated in their worship.

The truth is, that nowhere is the evidence of development in a wrong direction so strong as in the many customs of savage and barbarous nations which are more or less directly connected with Religion. The idea has long been abandoned that the savage lives in a condition of freedom as compared with the complicated obligations imposed by civilization. Savages, on the contrary, are under the tyranny of innumerable customs which render their whole life a slavery from the cradle to the grave. And what is most remarkable is the irrational character of most of these customs, and the difficulty of even imagining how they can have become established. They bear all the marks of an origin far distant in time—of a connection with doctrines which have been forgotten, and of conceptions which have run, as it were, to seed. They bear, in short, all the marks of long attrition, like the remnants of a bed of rock which has been broken up at a distant epoch of geological time, and has left no other record of itself than a few worn and incoherent fragments in some far-off conglomerate. Just as these fragments are now held together by common materials which are universally distributed, such as sand or lime, so the worn and broken fragments of old religions are held together, in the shape of barbarous customs, by those common instincts and aspirations of the human mind which follow it in all its stages, whether of growth or of decay.

The rapidity of the processes of degradation in Religion, and the extent to which they may go, depends on a great variety of conditions. It has gone very far indeed, and has led to the evolution of customs and beliefs of the most destructive kind among races which, so far as we know, have never been exposed to external conditions necessarily degrading. The innate character of this tendency to corruption, arising out of causes inherent in the nature of Man, becomes indeed all all the more striking when we find that some of the most terrible practices connected with religious superstition, are practices which have become established among tribes which are by no means in the lowest physical condition, and which inhabit countries highly blest by Nature. Perhaps there is no example of this phenomenon more remarkable than the "customs" of Dahomey, a country naturally rich in products, and affording every facility for the pursuits of a settled and civilized life. Yet here we have those terrible beliefs which demand the constant, the almost daily sacrifice of human life, with no other aim or purpose than to satisfy some imaginary Being with the sight of clotted gore, and with the smell of putrefying human flesh. This is only an extreme and a peculiarly terrible example of a general law, the operation of which is more or less clearly seen in every one of the religions of the heathen world, whether of the past or of the present time. In the very earliest ages in which we become acquainted with the customs of their worship, we find these in many respects strange and unaccountable, except on the supposition that even then they had come from far, and had been subject to endless deviations and corruptions through ages of a long descent.

Of no Religion is this more true than of that which was associated with the oldest civilization known to us—the civilization of Egypt. So strange is the combination here of simple and grand conceptions with grotesque symbols and with degrading objects of immediate wor-

[1] Hibbert Lectures, 1878.

[2] Hibbert Lectures, pp. 107, 108.

ship, that it has been the inexhaustible theme of curious explanations. Why a Snake or why a Dung-beetle should have been taken to represent the Divine Being, and why in the holiest recess of some glorious temple we find enshrined as the object of adoration the image or the coffin of some beast, or bird, or reptile, is a question on which much learned ingenuity has been spent. It has been suggested, for example, that a conquering race, bringing with it a higher and a purer faith, suffered itself to adopt or to embody in its system the lower symbolism of a local worship. But this explanation only removes the difficulty—if it be one—a step further back. Why did such sufferance arise? why was such an adoption possible? It was possible simply because there is an universal tendency in the human mind to developments in the wrong direction, and especially in its spiritual conceptions to become more and more gross and carnal.

Nor is it difficult to follow some, at least, of the steps of consequence—that is to say, the associations of thought—by which worship may become degraded when once any serious error has been admitted. Animal worship, for example, may possibly have begun with very high and very profound conceptions. We are accustomed to regard it as a very grotesque and degraded worship, and so no doubt it was in its results. But if we once allow ourselves to identify the Divine Power in Nature with any of its operations, if we seek for the visible presence of the Creator in any one of His creations, I do not know that we could choose any in which that presence seems so immanent as in the wonderful instincts of the lower animals. In a previous chapter we have seen what knowledge and what foreknowledge there is involved in some of these. We have seen how it often seems like direct inspiration that creatures without the gift of reason should be able to do more than the highest human reason could enable us to do—how wonderful it is, for example, that their prevision and provision for the nurture and development of their young should cover the whole cycle of operations in the second work of creation which is involved in the metamorphoses of insects—all this, when we come to think of it, may well seem like the direct working of the Godhead. We have seen in a former chapter that men of the highest genius in philosophical speculation, like Descartes, and men of the highest skill in the popular exposition of scientific ideas, like Professor Huxley, have been led by these marvels of instinct to represent the lower animals as automata or machines. The whole force and meaning of this analogy lies in the conception that the work done by animals is like the work done by the mechanical contrivances of men. We look always upon such work as done not by the machine but by the contriving mind which is outside the machine, and from whom its adjustments are derived. Fundamentally, however little it may be confessed or acknowledged, this is the same conception which, in a less scientific age, would take another form. What is seen in the action of an automaton is not the mechanism but the result. That result is the work of mind, which seems as if it were indwelling in the machine. In like manner, what is seen in animals is the wonderful things they do; and what is not seen, and is indeed wholly incomprehensible, is the machinery by which they are made to do it. Moreover, it is a machinery having this essential distinction from all human machines, that it is endowed with life, which in itself also is the greatest mystery of all. It is, therefore, no superficial observation of animals, but, on the contrary, a deep pondering on the wonders of their economy, which may have first suggested them to religious men as at once the type and the abode of that Agency which is supreme in Nature. I do not affirm as an historical fact that this was really the origin of animal worship, because that origin is not historically known, and, like the origin of Religion itself, it must be more or less a matter of speculation. Some animals may have become objects of worship from having originally been the subjects of sacrifice. The victim may have been so associated with the god to whom it was devoted as to become his accepted symbol. The Ox and the Bull may well have been consecrated through this process of substitution. But no such explanation can be given in respect to many animals which have been worshipped as divine. Perhaps no further explanation need be sought than that which would be equally required to account for the choice of particular plants, or particular birds and fishes, as the badges of particular tribes and families of men. Such badges were almost universal in early times, and many of them are still perpetuated in armorial bearings. The selection of particular animals in connection with worship would be determined in different localities by a great variety of conditions. Circumstances purely accidental might determine it. The occurrence, for example, in some particular region of any animal with habits which are at once curious and conspicuous, would sufficiently account for the choice of it as the symbol of whatever idea these habits might most readily suggest or symbolize. It is remarkable, accordingly, that in some cases, at least, we can see the probable causes which have led to the choice of certain creatures. The Egyptian beetle, the Scarabæus, for example, represents one of those forms of insect life in which the marvels of instinct are at once very conspicuous and very curious. The characteristic habit of the Scarabæus beetle is one which involves all that mystery of prevision for the development of the species which is common among insects, coupled with a patient and laborious perseverance in the work required, which does not seem directly associated with any mere appetite or with any immediate source of pleasure. The instinct by which this beetle chooses the material which is the proper nidus for its egg, the skill with which it works that material into a form suitable for the purpose, and the industry with which it then rolls it along the ground till a suitable position is attained—all these are a striking combination of the wonders of animal instinct, and conspicuous indication of the Spirit of wisdom and of knowledge which may well be conceived to be present in their work.

But although it is in this way easy to imagine how some forms of animal-worship may have had their origin in the first perception of what is really wonderful, and in the first admiration of what is really admirable, it is also very easy to see how, when once established, it would tend to rapid degradation. Wonder and reverence are not the only emotions which impel to worship. Fear, and even horror, especially when accompanied with any mystery in the objects of alarm, are emotions suggesting, perhaps, more than any, that low kind of worship which consists essentially in the idea of deprecation. Some hideous and destructive animals, such as the crocodile, may have become sacred objects neither on account of anything admirable in their instincts, nor on account of their destructiveness; but, on the contrary, because of being identified with an agency which is beneficent. To those who live in Egypt the Nile is the perennial source of every blessing necessary to life. An animal so characteristic of that great river may well have been chosen simply as the symbol of all that it was, and of all that it gave to men. There is no mystery, therefore, in the crocodile being held sacred in the worship of the God of Inundation. But there are other animals which have been widely invested with a sacred character, in respect to which no such explanation can be given. The worship of serpents has been attributed to conceptions of a very abstract character—with the circle, for example, into which they coil themselves, considered as an emblem of Eternity. But this is a conception far too transcendental and far-fetched to account either for the origin of this worship or for its wide extension in the world. Serpents are not the only natural objects which present circular forms. Nor is this attitude of their repose,

curious and remarkable though it be, the most striking peculiarity they present. They have been chosen, beyond any reasonable doubt, because of the horror and terror they inspire. For this, above all other creatures, they are prominent in Nature. For their deceptive coloring, for their insidious approach, for their deadly virus, they have been taken as the type of spiritual poison in the Jewish narrative of the Fall. The power of inflicting almost immediate death, which is possessed by the most venomous snakes, and that not by violence but by the infliction of a wound which in itself may be hardly visible, is a power which is indeed full of mystery even to the most cultivated scientific mind, and may well have inspired among men in early ages a desire to pacify the powers of evil. The moment this becomes the great aim and end of worship, a principle is established which is fertile in the development of every foul imagination. Whenever it is the absorbing motive and desire of men to do that which may most gratify or pacify malevolence, then it ceases to be at all wonderful that men should be driven by their religion to sacrifices the most horrid, and to practices the most unnatural.

But if we wish to see an illustration and an example of the power of all conceptions of a religious nature in the rapid evolution of unexpected consequences, we have such an example in the case of one man who has lived in our own time, and who still lives in the school which he has founded. I refer to Auguste Comte. It is well known that he denied the existence, or at least denied that we can have any knowledge of the existence, of such a Being as other men mean by God. Mr. John Stuart Mill has insisted with much earnestness and with much force that, in spite of this denial, Auguste Comte had a religion. He says it was a religion without a God. But the truth is, that it was a religion having both a creed and an ideal object of worship. That ideal object of worship was an abstract conception of the mind so definitely invested with personality that Comte himself gave to it the title of The Great Being (*Grand Etre*). The abstract conception thus personified was the abstract conception of Humanity—Man considered in his past, his present, and his future. Clearly this is an intellectual Fetish. It is not the worship of a Being known or believed to have any real existence; it is the worship of an idea shaped and molded by the mind, and then artificially clothed with the attributes of personality. It is the worship of an article manufactured by the imagination, just as Fetishism, in its strictest meaning is the worship of an article manufactured by the hand. Nor is it difficult to assign to it a place in the classification of religions in which a loose signification has been assigned to the term Fetishism. The worship of Humanity is merely one form of animal-worship. Indeed, Comte himself specially included the whole animal creation. It is the worship of the creature Man as the consummation of all other creatures, with all the marvels and all the unexhausted possibilities of his moral and intellectual nature. The worship of this creature may certainly be in the nature of a religion, as much higher than other forms of animal worship as Man is higher than a beetle, or an ibis, or a crocodile, or a serpent. But so also, on the other hand, it may be a religion as much lower than the worship of other animals, in proportion as man can be wicked and vicious in a sense in which the beasts cannot. Obviously, therefore, such a worship would be liable to special causes of degradation. We have seen it to be one of the great peculiarities of Man, as distinguished from the lower animals, that whilst they always obey and fulfill the highest law of their being, there is no similar perfect obedience in the case of Man. On the contrary, he often uses his special powers with such perverted ingenuity that they reduce him to a condition more miserable and more degraded than the condition of any beast. It follows that the worship of Humanity must, as a religion, be liable to corresponding degradation. The philosopher, or the teacher, or the prophet who may first personify this abstract conception, and enshrine it as an object of worship, may have before him nothing but the highest aspects of human nature, and its highest aspirations. Mill has seen and has well expressed the limitations under which alone such a worship could have any good effect. "That the ennobling power of this grand conception may have its full efficacy, he should, with Comte, regard the *Grand Etre*, Humanity or Mankind, as composed in the past solely of those who, in every age and variety of position, have played their part worthily in life. It is only as thus restricted that the aggregate of our species becomes an object worthy our veneration."[3] This, no doubt, was Comte's own idea. But how are his disciples and followers to be kept up to the same high standard of conception? Comte seems to have been personally a very high-minded and a very pure-minded man. His morality was austere, almost ascetic, and his spirit of devotion found delight in the spirit of the Christian Mystics. Yet even in his hands the development of his conceptions led him to results eminently irrational, although it cannot be said that they were ever degrading or impure. But we have only to consider how comparatively rare are the examples of the the highest human excellence, and how common and prevailing are the vices and weakness of Humanity, to see how terrible would be the possibilities and the probabilities of corruption in a religion which had Man for the highest object of its worship. Nor is this all that is to be said on the inevitable tendency to degradation which must attend any worship of Humanity. Not only are the highest forms of human virtue rare, but even when they do occur, they are very apt to be rejected and despised of men. Power and strength, however vicious in its exercise, almost always receives the homage of the world. The human idols, therefore, who would be chosen as symbols in the worship of humanity, would often be those who set the very worst examples to their kind. Perhaps no better illustration of this could be found than the history of Napoleon Buonaparte. I think it is impossible to follow that history, as it is now known, without coming to the conclusion that in every sense of the word he was a bad man—unscrupulous, false, and mean. But his intellect was powerful, whilst his force and energy of character were tremendous. These qualities alone, exhibited in almost unexampled military success, were sufficient to make him the idol of many minds. And as mere success secured for him this place, so nothing but failure deprived him of it. Not a few of the chosen heroes of Humanity have been chosen for reasons but little better. Comte himself, seeing this danger, and with an exalted estimate and ideal of the character of womanhood, had laid it down that it would be best to select some woman as the symbol, if not the object, of private adoration in the worship of Humanity. The French Revolutionists selected a woman, too, and we know the kind of woman that they chose. It may be wise, perhaps, to set aside this famous episode in a fit of national insanity as nothing more than a profane joke; but the developments of anthropomorphism in the mythology of the Pagan world are a sufficient indication of the kind of worship which the worship of Humanity would certainly tend to be.

The result, then, of this analysis of that in which all Religion essentially consists, and of the objects which it selects, or imagines, or creates for worship, is to show that in Religion, above all other things, the processes of evolution are especially liable to work in the direction of degradation. That analysis shows how it is that in the domain of religious conceptions, even more than in any domain of thought, the work of development must be rapid, because, in the absence of revelation or the teachings of Authority, fancy and imagination have no guide and are under no restraint.

[3] Mill's "Comte and Positivism," p. 136.

When, now, we pass from the phenomena which Religion presents in the present day to what we know of its phenomena in the earliest historic times, the conclusions we have reached receive abundant confirmation. Of the Origin of Religion, indeed, as we have already seen, history can tell us nothing, because, unless the Mosaic narrative be accepted, there is no history of the origin of Man. But the origin of particular systems of Religion does come within the domain of history, and the testimony it affords is always to the same effect. In regard to them we have the most positive evidence that they have been uniformly subject to degradation. All the great religions of the world which can be traced to the teaching or influence of individual men have steadily declined from the teaching of their founders. In India it has been one great business of Christian missionaries and of Christian governors, in their endeavors to put an end to cruel and barbarous customs, to prove to the corrupt disciples of an ancient creed that its first prophets or teachers had never held the doctrines from which such customs arise, or that these customs are a gross misconception and abuse of the doctrine which had been really taught. Whether we study what is now held by the disciples of Buddha, of Confucius, or of Zoroaster, it is the same result. Wherever we can arrive at the original teaching of the known founders of religious systems, we find that teaching uniformly higher, more spiritual than the teaching now. The same law has effected Christianity, with this difference only, that alone of all the historical religions of the world it has hitherto shown an unmistakable power of perennial revival and reform. But we know that the processes of corruption had begun their work even in the lifetime of the Apostles; and every church in Christendom will equally admit the general fact, although each of them will give a different illustration of it. Mohammedanism, which is the last and latest of the great historical religions of the world, shows a still more remarkable phenomena. The corruption in this case began not only in the lifetime but in the life of the prophet and founder of that religion. Mahomet was himself his own most corrupt disciple. In the earliest days of his mission he was best as a man and greatest as a teacher. His life was purer and his doctrine more spiritual when his voice was a solitary voice crying in the wilderness, than when it was joined in chorus by the voice of many millions. In his case the progress of development in a wrong direction was singularly distinct snd very rapid. Nor is the cause obscure. The spirit of Mahomet may well have been in close communion with the Spirit of all truth, when, like St. Paul at Athens, his heart was stirred within him as he saw his Arabian countrymen wholly given to idolatry. Such deep impressions on some everlasting truth—such overpowering convictions—are in the nature of inspiration. The intimations it gives and the impulses it communicates are true in thought and righteous in motive, in exact proportion as the reflecting surfaces of the human mind are accurately set to the lights which stream from Nature. This is the adjustment which gives all their truthfulness to the intimations of the senses; which gives all its wisdom and foresight to the wonderful work of instinct; which gives all their validity to the processes of reason, which is the real source of all the achievements of genius; and which, on the highest level of all, has made some men the inspired mouthpiece of the oracles of God. But it is the tenderest of all adjustments—the most delicate, the most easily disturbed. When this adjustment is, as it were, mechanical, as it is in the lower animals, then we have the limited, but, within its own sphere, the perfect wisdom of the beasts. But when this adjustment is liable to distortion by the action of a Will which is to some extent self-determined and is also to a large extent degraded, then the real inspiration is not from without, but from within—then the reflecting surfaces of mind are so longer set true to the light of Nature; and then "if the light within us be darkness, how great is that darkness!" Hence it is that one single mistake or misconception as to the nature and work of inspiration is, and must be a mistake of tremendous consequence. And this was Mahomet's mistake. He thought that the source of his inspiration was direct, immediate, and personal. He thought that even the very words in which his own impulses were embodied were dictated by the Angel Gabriel. He thought that the Supreme Authority which spoke through him when he proclaimed that "the Lord God Almighty was one God, the Merciful, the Compassionate," was the same which also spoke to him when he proclaimed that it was lawful for him to take his neighbor's wife. From such an abounding well-spring of delusion the most bitter waters were sure to come. How different this idea of the methods in which the Divine Spirit operates upon the minds of men from the idea held on the same subject by that great Apostle of our Lord whose work it was to spread among the Gentile world those religious conceptions which had so long been the special heritage of one peculiar people! How cautious St. Paul is when expressing an opinion not directly sanctioned by an authority higher than his own! "I think also that I have the Spirit of God." The injunction, "Try the spirits whether they be of God," is one which never seems to have occurred to Mahomet. The consequences were what might have been expected. The utterances of his inspiration when he was hiding in the caves of Mecca were better, purer, higher than those which he continued to pour forth when, after his flight to Medina, he became a great conqueror and a great ruler. From the very first indeed he breathed the spirit of personal anger and malediction on all who disbelieved his message. This root of bitterness was present from the beginning. But its developments were indeed prodigious. It was the animating spirit of precepts without number which, in the minds and in the hands of his ruthless followers, have inflicted untold miseries for twelve hundred years on some of the fairest regions of the globe.

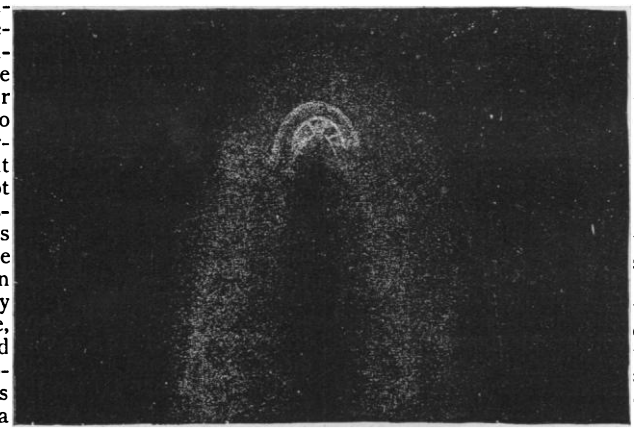
Passing now from the evidence of the law of corruption and decline which is afforded by this last and latest of the great historical religions of the world, we find the same evidence in those of a much older date. In the first place, all the founders of those religions were themselves nothing but reformers. In the second place the reforms they instituted have themselves all more or less again yielded to new developments of decay. The great prophets of the world have been men of inspiration or of genius who were revolted by the corruptions of some pre-existing system, and who desired to restore some older and purer faith. The form which their reformation took was generally determined, as all strong revolts are sure to be, by violent reaction against some prominent conception or some system of practice which seemed, as it were, an embodiment of its corruption. In this way only can we account for the peculiar direction taken by the teaching of that one great historical Religion which is said to have more disciples than any other in the world. Buddhism was in its origin a reform of Brahminism. In that system the beliefs of a much older and simpler age had become hid under the rubbish-heaps of a most corrupt development. Nowhere perhaps in the world had the work of evolution been richer in the growth of briers and thorns. It had forged the iron bonds of caste, one of the very worst inventions of an evil imagination; and it had degraded worship into a complicated system of sacrifice and of ceremonial observances. There seems to be no doubt that the teaching of the reformer Sakya Muni (Buddha) was a revolt and a reform. It was a reassertion of the paramount value of a life of righteousness. But the intellectual conceptions which are associated with this great ethical and spiritual reform had within themselves the germs of another cycle of decay.

(To be continued.)

THE COMET.

The comet is daily becoming a fainter object, and astronomers are now employed in making investigations based on their observations.

We understand that Professor O. Stone, of Cincinnati, has published a statement that he saw the nucleus of the comet divide into two parts. Professor Stone is not one likely to be mistaken in an observation of this nature, but we understand he has not been confirmed in this discovery, as observations since made with the large equatorial at Washington have failed to show any division. A disturbance, however, has been observed in the nucleus, which Professor Skinner considers might be mistaken for a division as described by Professor Stone.

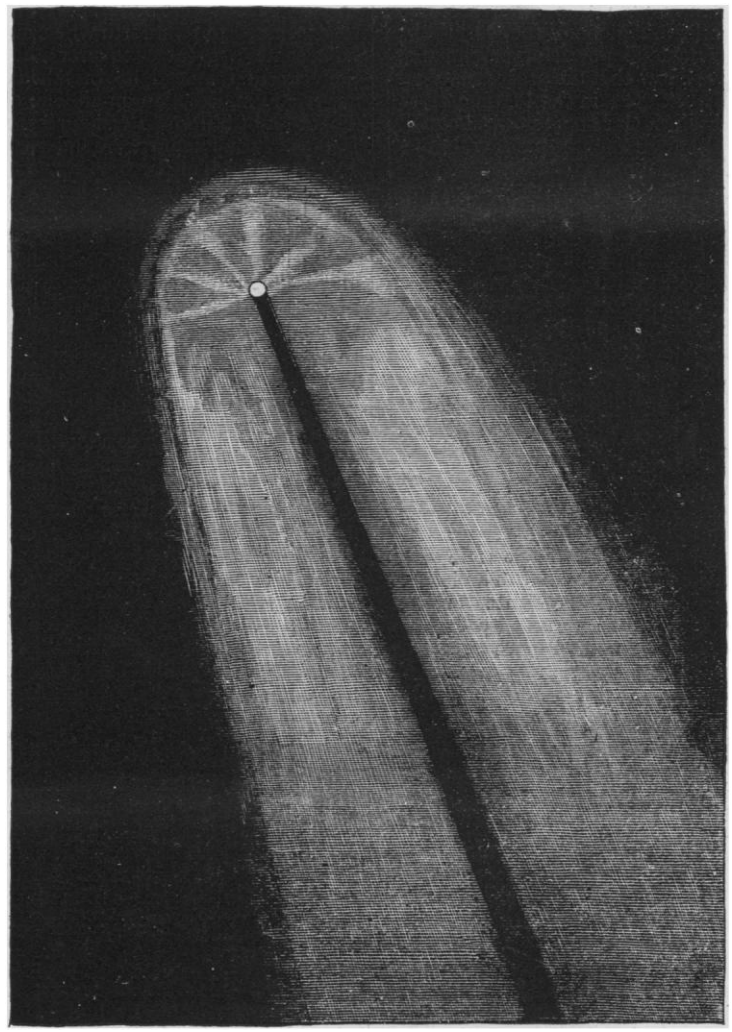


HEAD OF DONATI'S COMET, AFTER BOND.

On the 6th of July the comet was observed by Mr. Rock of the Naval Observatory, who thus describes what he saw:

"A bright tongue of light about one revolution long in direction of tail, with a slight node near end and curved."

In explanation of this Mr. Rock said: "I observed the comet at the time of its lower culmination about twenty minutes after midnight. The nucleus did not appear to be divided, but a bright band streamed out in the direction of the tail. This band was about fifteen seconds of the arc in length. Near the end of it was a bright spot, and that portion of the band extending beyond it was curved in the same general direction as the tail, but in a somewhat shorter arc. It is possible that the observer at Cincinnati was not able to distinguish the band of light which I saw uniting the nucleus and the node, and so concluded that he saw two nuclei. When I first observed the comet, on June 28, the coma was apparently homogeneous as it also was on July 2. On June 28, however, there were two spurs of light spreading away from the opposite sides of the head like angel's wings. On July 2, I did not observe these at all or they were very faint. On July 6 I observed the appearance that I have described. It may be that this was the same thing that I saw on June 28, observed from a different point of view. It is not improbable, however, that the nucleus has really divided. Comets appear to have a tendency to do that.



COMET OF 1881. AFTER PROF. HENRY DRAPER'S PHOTOGRAPH.

To a correspondent of the N. Y. *Tribune*, Professor Harkness said:

"We think that the November meteors are the debris of a comet which first made its appearance about the year 900. This debris, to all appearance, continues to trail along the whole orbit of the comet of which it formed a part and which has disappeared. The August meteors are assigned a similar origin. Biela's comet reappeared once after its nucleus had separated into two parts; it has never been observed since. All comets appear to diminish in brightness, and it is probable that they become gradually disintegrated. I have undertaken spectroscopic investigation of this comet, sufficient to convince me that the spectrum is the same as that of all comets. I made observations on June 28 and July 1 and 2. On June 28, I found a bright continuous spectrum with three bands very hazy, the whole indistinct. Evidence of polarization was not trustworthy, and I concluded there was no polarization. On July 1 the spectrum of the nucleus was right, showing two bands; wave lengths approximately 550.29 and 611.5. On July 2, I found a bright, continuous spectrum extending from about wave length 577 to 428; the coma gave three bright bands; wave lengths

approximately 548.4, 513.3, 467.2. The tail gave no continuous spectrum. The mean of eighteen comets observed gives us wave lengths as follows: 556.4, 512.7 and 470.6; the mean of two nights' work on this comet gave me 549.3, 512.4 and 467.2. These two sets of figures agree as nearly as could be expected, considering that I used in my observations a single 60° prism, and there can be no doubt whatever that this is the usual comet spectrum."

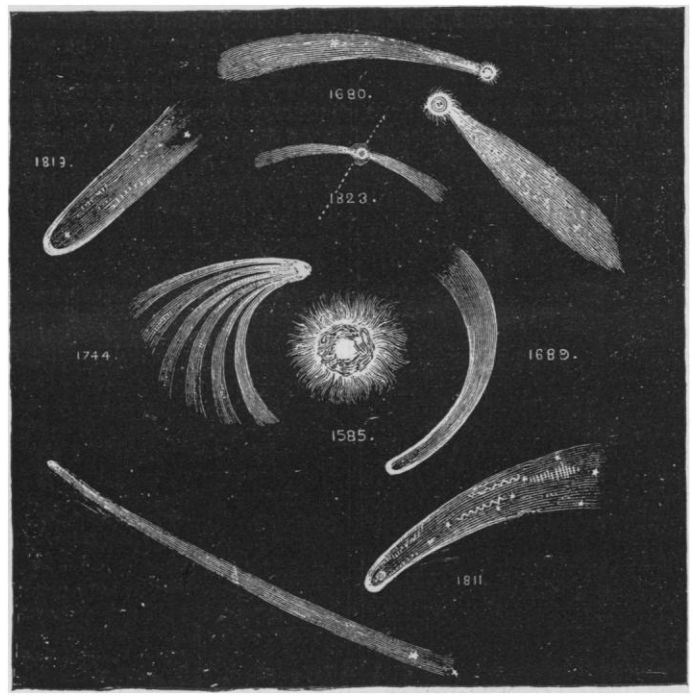
Professor A. Hall also observed that he had received from Baron Struve, of the Imperial Observatory at Palkova, an ephemeris of Encke's comet extending from July 29 to November 14, and preparations are making at the Naval Observatory for careful observations of that body, which is considered of great scientific interest.

We present our readers with an illustration showing the appearance of the comet in one of Professor Henry Draper's photographs for which we are indebted to Messrs. Harper Brothers, and we hope to shortly publish Professor Draper's mature views based on his observations and photographs, both of the comet and its spectrum.

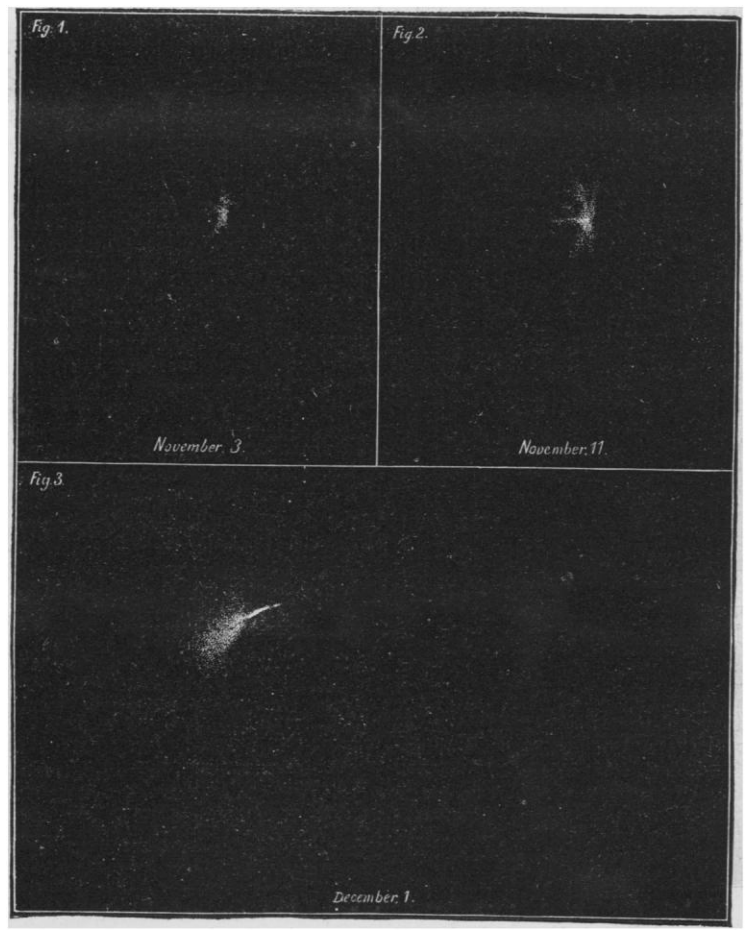
To a correspondent Prof. Draper gave the following particulars:

"In the spectrum of the comet there is one great band in the ultra-violet region beyond the line H. This morning I brought the spectroscope with me to the city, and have taken photographs of the spectrum of the electric arc with it. The electric arc contains carbon; not, in all probability, the pure element of carbon volatilized, but some compound of carbon—most likely a hydrocarbon. The spectrum of the electric or voltaic arc shows a strong band at the ultra-violet region, due to the presence of this carbon or carbon-compound. This spectrum I mean to compare with that of the comet, to see whether the bands in the ultra-violet region correspond in the two. If they do, the presence of some form of carbon in the comet will be demonstrated. My impression at present is that the ultra-violet spectrum of the comet does prove that it contains carbon, but I cannot speak with certainty until after I have made more careful measurements of the photographs. At all events, my experiments must settle the question.

We are indebted to Professor Pickering, of Harvard University, for some valuable observations which will be found in another column.



GROUP OF VARIOUS COMETS.



VIEWS OF ENCKE'S COMET, 1871

ON THE TAILS OF COMETS.

One of the most important articles in the June number of *Urania* is that by M. Th. Bredichin, on the Tails of Comets. After a series of investigations he arrives at the conclusion that the position, curvature and structure of a tail are explained by the repulsive force of the sun and by the effluvia of cometary matter from the nucleus towards the sun with a certain initial velocity or repulsion.

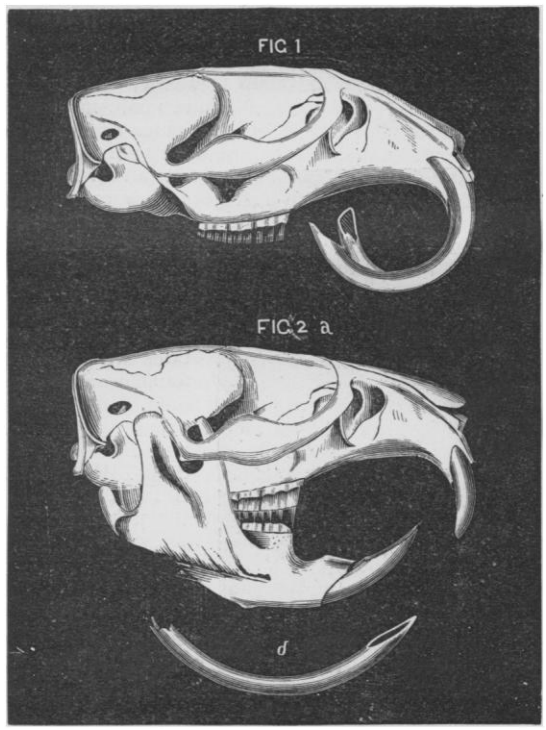
ON THE OVERGROWN TEETH OF FIBER WIBETHICUS.

By Herman L. Fairchild.

No group of animals is more clearly marked by a single feature than the *Rodentia* by their peculiar incisor teeth. Except in the Rabbits which have a supplementary pair in the upper jaw, the number is always four. The enamel is mostly, sometimes wholly, on the anterior surface; where also the dentine is harder. The constant abrasion consequently preserves a keen chisel edge which admirably adapts them for gnawing. This purpose requires them to be of a certain length. To keep that length, the loss from wear is compensated by continual outward growth from the base, the growth being supplied from permanent pulp. The outward growth and the terminal wear are nicely balanced.

It is evident that a loss of one incisor prevents abrasion of the opposing tooth, which, continuing to push outward, may become so long as to interfere with the proper use of the jaws and the remaining teeth. Such cases, while not unknown, are sufficiently rare to be of great interest to the naturalist, and of wonderment to the unscientific.

* Fig. 1, represents a striking example of such malforma-



tion in the case of a muskrat, *Fiber Wibethicus*. The figure is three-fourths the size of the specimen. This skull was found on the bank of Sacandaga River, town of Edinburgh, Saratoga Co., N. Y. Unfortunately no other portion of the skeleton was collected; but the most unobserving could not fail to notice such remarkable teeth. It was naturally supposed that some strange creature had been discovered. Falling into the hands of the writer its character was discovered and a normal specimen was procured for accurate comparison. The latter is shown in figure 2.

When removed from their sockets the overgrown incisors show a growth nearly to a complet circle, although the curvature is somewhat spiral. Their terminations exhibit the normal form produced by abrasion at a time when the teeth were of the proper length, and are naturally discolored with foreign matter on account of long disuse. The yellow color of the front surface of these incisors is fainter towards the ends, but still marked.

As the mandible is missing it is impossible to know what was the difficulty with the lower incisors. They might have been broken by severe usage or carried away by a gun-shot. But that the animal once possessed them is shown by the naturally abraded ends of the remaining ones. The trouble seems to have been of a character which prevented the after growth of the lower incisors. For if they had grown out again after an injury, they would have been forced to take a position in front of the lengthened upper incisors. This would have prevented the forward and backward motion necessary for mastication, and so prominent in Rodents, and moreover would undoubtedly have worn the anterior surfaces of the overgrown upper teeth. But the latter do not show the least unnatural abrasion, while the molars do show that they were used. Probably the breaking of the teeth near the bone would have so exposed the pulp as to destroy it and the implanted part of the injured teeth.

The fairly clean fresh surfaces of all the upper molars would indicate that the lower molars were quite intact and that the greatly lengthened teeth did not interfere with mastication, however much they interfered with prehension. The accumulation of foreign matter upon the sides of the molars is greater than on those of the normal skull. Perhaps this is due to less discrimination in choice of food, and possibly to somewhat greater age.

That the animal lived some considerable time after its misfortune, is proven by the great length of the teeth. The time required for this growth is unknown. It is, however, a very interesting point and should be determined. The rate of growth of the incisors may vary, possibly in the same individual, according to the kind of food and consequent wear; at least it would not be right to assume that the rate of growth is always the same. Observation upon a Rabbit or other rodent would be valuable but not conclusive, as the rabbit is entirely vegetarian in diet while the Muskrat is quite omnivorous. To answer the question before us, the observation should be made upon a Muskrat having the lower incisors removed or rendered useless, in order to repeat as nearly as possible the conditions under which we imagine our specimen existed.

As the ends of the overgrown incisors had long passed the point of greatest interference they did not prevent the taking of food with the mouth; and the creature probably did not die from starvation.

If the readers of "SCIENCE" can give any facts bearing on this matter from their personal knowledge and observation they will confer a favor by sending them to these columns.

In *Forest and Stream* of April 4, 1878, there is a sketch of a Woodchuck's skull showing an abnormal lengthening of both pairs of incisors, which, according to the description, did not prevent the animal from procuring sufficient food to keep it in good condition. And Owen's "Odontography" briefly describes (page 411, old ed.) the abnormal elongation of the incisors of rodents; and notices the skull of a beaver, of which a lower incisor formed a complete circle. Plate 104, Fig. 7, of the above work, also shows the abnormal upper incisors of a rabbit.

* This illustration was used, without comment, in an article by the writer in the *Popular Science Monthly* for June, 1880.

Absorbing Power of the Atmosphere.—M. Laight had long ago shown that the radiating light of the sun is largely absorbed by the layer of atmosphere. But penetrating more deeply into the question, he has successively and separately studied the absorption undergone by each ray of the spectrum. He concludes that these diverse rays are from being equally absorbed, and that the radiation is modified according to the degree of absorption. One of the results of this interesting fact is that the color of the sun is different from that which we attribute to him.

BOOKS RECEIVED.

ANTHROPOLOGY: An Introduction to the Study of Man and Civilization, by EDWARD B. TYLOR, D. C. L., F. R. S. With Illustrations. D. Appleton & Co., New York, 1881.

The present volume is one which will be very acceptable to a large class of scientific readers, for it places before them within the compass of a book of three hundred pages, the principles on which the science of Anthropology is based, and a synopsis of the mass of facts collected and arranged by Anthropologists, which are scattered in some fifty standard works and hundreds of independent papers on the subject.

As an introduction to the science of Anthropology, Dr. Tylor's work is a great success, and if carefully studied will save a vast amount of desultory reading on the part of the student, and as strictly technical details are carefully avoided, the author has succeeded in bringing the subject within reach of readers who have received or are receiving the ordinary higher English education.

The work opens with a brief but sufficiently comprehensive survey of the varieties of men, their language, their civilization and their ancient relics, thus showing by vestiges of man's early existence, what proofs we have of his first appearance and ultimate development.

The most common observer cannot fail to notice the broad distinction among races of men, but it is only within modern times that these distinctions have been worked out by scientific methods. One of the first questions which arise in tracing the history of mankind, is, did man originate from one stock in some primitive centre, and afterwards spread far and wide, or are the Negroes, Mongolians, Whites and other races distinct species, each sprung from a separate origin.

Dr. Tylor favors the views propounded by modern zoologists, which is against the several origins of mankind, for two principal reasons. First, that all tribes of men, from the blackest to the whitest, the most savage to the most cultured, have such general likeness in the structure of their bodies and the working of their minds,—as is easiest and best accounted for by their being descended from a common ancestry, however distant,—and secondly, that all the human races, notwithstanding their form and color, appear capable of freely intermarrying and forming cross races of every combination, which appears to point to a common ancestry. The author therefore advises the acceptance of this theory of the unity of mankind as best agreeing with ordinary experience and scientific research.

Any decision on this subject, however, must be considered provisional only, as our means of judging what man's progenitors were like, both in mind and body, before the forefathers of the present negroes and Tartars and Australians were separated into distinct stocks, is at the best most imperfect. Nor is it yet clear by what causes these stocks or races passed into their different types of skull and limbs, of complexion and hair.

We find no aid from the study of ancient inscriptions and figures, as to the condition of races at the beginning of historic times.

Figures of Egyptians drawn more than 4000 years ago, describe features very similar to those found in Egypt at the present day. The celebrated inscription of Prince Una, dating back 2000 years B. C., makes mention of the *Nahsi* or Negroes who were levied and drilled by ten thousands for the Egyptian army; and on the tomb of Knumkept of the 12th dynasty there is represented a procession of *Amu*, who are seen by their features to be of the race to which Syrians and Hebrews belonged. In fact all the evidences derived from ancient monuments, geography and history, prove that the great race-divisions of mankind are of no recent growth, but were already settled before the beginning of the historical period. We must then look to the prehistoric period as the time when the chief work was done of forming and spreading over the world the races of mankind.

We might expect that "language" would tell of man's age on the earth, but the reader of this work will find that although there is evidence that all recent language was derived from one primitive language, the most patient research shows that all trace of that primitive language is lost.

The first chapter of Dr. Tylor's work includes a history of the civilization of man and his gradual development in the appreciation of Art. The first traces of man in the stone age is described, dating back from twenty to a hundred thousand years, presenting evidence that, even at that remote period, man possessed all the attributes of humanity in a savage and rude condition.

In the second chapter man is compared with the brute creation. To show how man may have advanced from savagery to civilization is a reasonable task and is worked out to some extent by the author. But the evidence is wanting for crossing that mental gulf that divides the lowest savage from the highest ape.

The general conclusion advanced by the author in this branch of the subject is expressed by Dr. Tylor as follows: "On the whole the safest conclusion warranted by facts is that the mental machinery of the lower animals is roughly similar to our own, up to a limit. Beyond this limit the human mind opens out into a wide range of thought and feeling which the beast mind shows no sign of approaching. If we consider man's course of life from birth to death, we see that it is, so to speak, founded on functions which he has in common with lower beings. Man, endowed with instinct and capable of learning by experience, drawn by pleasure and driven by pain, must like the beast, maintain his life by food and sleep, must save himself by flight, or fight it out with his foes, must propagate his species and care for the next generation. Upon this lower framework of animal life is raised the wondrous edifice of human language, science, art and order."

To the many who have yet to master the principles of this, the latest of sciences, "*Anthropology*," we commend this book as one which will be read with much satisfaction and profit, for the study of man and civilization is not a matter of scientific interest only, but at once passes into the practical business of life. We have in it the means of understanding our own lives and our place in the world, vaguely and imperfectly, it is true, but at any rate more clearly than any former generation.

The knowledge of man's course of life from the remotest past to the present, will not only help us to forecast the future, but, says the author, guide us in our duty of leaving the world better than we found it.

CORRESPONDENCE.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

FIRE BALLS.

To the Editor of "SCIENCE":—

The interesting instance, narrated in a recent number of "SCIENCE," of the descent of fire balls as observed by Henry O. Forbes, calls to mind two occurrences which I have witnessed under circumstances favorable for accurate observation.

One sultry summer day, at sea, I was lying on the deck of a small schooner, watching in the sky the gathering clouds of a sudden and violent thunder shower. I was looking over the main mast, whose top was in the centre of my field of view. As the first scattered drops of rain began to fall, and in advance of any lightning or thunder, there appeared upon the top of the mast a brush of fire

remarkably like that which is often produced on a small scale in electrical experiments. This brush shone very distinctly against the heavily overcast and darkened sky; and it looked about as large as the hand of a half-grown child, with the fingers spread moderately apart. After one or two seconds it seemed to change into a ball of fire, of smaller size but greater intensity, and distinctly round in outline, which glided smoothly down the surface of the mast and across the wooden deck, until it passed over the stern of the boat and entered the water with an explosion not unlike the report of a large pistol. There was no lightning-rod upon the vessel, but the wood of the mast and of the deck was quite wet by the time the ball passed over it. The electrical disturbance did not approach the mast with a visible flash, and the sound of the explosion, the only sound noticed, was decidedly from the direction where the ball entered the water. The ball left the mast in a line at right angles to a tangent at the point of departure, while the nearest course to the sea would have been in the direction of the tangent; but having once commenced to cross the deck it took a perfectly straight course. The wood over which it passed was slightly discolored in several places, but not at all charred.

On another occasion I was standing, with several companions, in a carriage-house, in the country, having taken refuge there from a sudden shower. Through an open door we were gazing intently upon a large barn near by, discussing the safety of occupying that more commodious retreat, when a flash of lightning, in the usual zigzag form, passed obliquely from the clouds to the barn, striking the ridge at the very summit of the roof. Thence it passed, as a distinct ball of fire, over the wet shingles down the surface of the roof to the eaves and there entered the barn. We thought there was a report as the ball entered the barn, which had been recently filled with freshly gathered hay, but were not certain, owing to the nearly, if not practically, simultaneous arrival of the thunder sound. The nearest door of the barn was opened within a very few seconds, and the interior was found filled with fire and smoke; although the roof over which the ball had passed remained unaffected until destroyed by fire breaking out from within the building. Although I had been the only one in the party to insist in taking refuge in the carriage-house instead of the barn, there seemed to arise on the part of the majority a considerable unwillingness to further dwell upon the reasons for preferring the latter place of safety.

R. H. WARD, M. D.

To the Editor of "SCIENCE."

Allow me in reply to R. C. S. again to tell him, most emphatically, that I have never entertained, for a moment, the idea of "reviving" or advocating the theory that motor cells can be distinguished from sensory ones by their size. In order to "revive" a theory it must be restated in some form. In the "transactions" of the American Neurological Association, published in the *Journal for Nervous and Mental Disease*, July, 1880, p. 476, I am correctly reported as stating that "so far as sensation went, it had nothing to do with the subject of the paper." My theory relates exclusively to the nuclie in so-called motor cells. They are called motor not by any means on account of their size, but from their evident connection with motor filaments. In spite of my denial, R. C. S. still asserts the wrong thing, and shows none of the customary regret at having possibly misunderstood me.

Prof. Stieda is referred to by me not to "polemize" against him, but to show that, while he had measured their cells and their nuclie in the spinal cord of turtles, he had not anticipated me in attributing difference in size to difference in energy. Stieda's expression is; Physiologische Dignität, which I translate physiological importance. As neither sensation nor sensory cells are here mentioned by him, it seemed plain that he, like myself, referred solely to cells of the spinal cord which, by their close relation to motor filaments, are supposed to have a motor function.

The careful reader for whom R. C. S. so dogmatically responds, is respectfully requested to bear in mind that the three brief articles which I have published, relate throughout to Reptiles and Batrachians, and not to mammals. With this reminder he will have, I think, no difficulty in reading, in some places, between the lines.

As to the auditory nerve centres, it remains for me to state that the paragraph which R. C. S. quotes was offered as a mere suggestion to one who seemed also to think that the large cells in the vicinity of the roots of the auditory nerve, in the iguana, bore some relation to my theory. As his communication was stated to be preliminary in character, and had nothing to do with my subject, I decided to make no personal reference, suggesting that these cells (as claimed fourteen years ago by Deiters) were of doubtful function, and that the cells related to vision and olfaction were (in reptiles, etc.,) all very small. This, I believe, is true, but it revives no theory.

I leave my unknown critic to the contemplation of this clause which appears in his last publication: "Notwithstanding the construction which Dr. J. J. Mason now desires to see placed upon his words," doing him the justice to suppose that he knows what he insinuates, and that being mortal, he will hasten to admit that he may have misunderstood me.

JOHN J. MASON, M. D.

NEWPORT, R. I., July 2, 1881.

DECOMPOSITION OF WATER.—In decomposing water by discharging Leyden jars through platinum electrodes, Dr. Streintz finds that, with very small electrodes giving passage to a series of discharge currents in one direction, and then left to themselves, a remarkable reversal of E.M.F. occurs, but only when the discharges do not exceed a certain number. Dr. Streintz made use of a quadrant-electrometer in his experiments.

SIMPLE METHOD OF DETERMINING THE TEMPORARY HARDNESS OF WATER.—In order to ascertain the alkalinity of springs on the spot, with samples not exceeding 10 c.c., and with a single reagent, the author makes use of a tube of 30 to 40 c.m. long, closed at the bottom, and with a mark showing the capacity of 10 c.c. From this mark upwards the tube is graduated into 0.1 c.c. To determine the temporary hardness the tube is filled to the lowest mark with the water in question, and a little piece of filter-paper, which has been previously steeped in extract of logwood and dried, is thrown in, thus giving the water a violet color. Centinormal hydrochloric acid is then added from a dropping bottle, till the color of the liquid inclines to an orange. The tube is then closed with the thumb and well shaken. The greater part of the carbonic acid escapes, and the liquid becomes red again. Acid is again added, and the shaking repeated until the next drop of the acid turns the liquid to a pure lemon-yellow, a point which a little practice is easily reached. The amount of acid used is read off on the tube itself. The author proposes to express the alkalinity of a water by the number of c.c. of centinormal acid needed to neutralise 10 c.c. He thinks that this method will be found useful both for sanitary and geological purposes.—V. WARTHA.

CHEMISTRY OF THE PLATINUM METALS.—Contrary to the prevalent view, all the platinum metals, if precipitated by zinc in a state of very fine division, are soluble to a considerable extent in nitric acid, whether weak or strong, so that palladium cannot be separated from such a mixture by means of nitric acid. The solubility appears to depend on the relative proportion of one or other of the metals in the

mixture (mass action.) Pure palladium, even in thin leaves, is not easily soluble in nitric acid, whilst all the other platinum metals are perfectly insoluble if in a moderately compact condition. Palladium cannot be isolated by agitation with mercury from a solution which, along with the platinum metals contain base metals, such as copper, lead, &c., since the mercury precipitates, not merely the palladium, but all the other platinum metals, forming probably amalgams. From the platinum metals thus precipitated by mercury, metal free from mercury cannot be obtained by distillation and subsequent ignition, since a part of the mercury forms a stable compound with the platinoids. —THEODOR WILM.

GLYCERIN.—Notwithstanding the low price which prevails for almost every description of raw produce and manufactured goods, there are a few articles which form notable exceptions. Perhaps one of the most remarkable of these is refined glycerin, which, within the last two years, has advanced from about £30 to £130 per ton avoirdupois for 30° B. This enormous advance is due partly to increased consumption, diminished production and the influence of speculation working on a market devoid of stocks. In view of the present position of the article and the prospect of a continuance of high prices for a considerable time to come, the attention of soapmakers is now being turned to the utilization of their waste "leys," and various new processes for recovering the glycerin contained in these liquors have lately been tried with more or less successful results. Apart from minor impurities, waste soap "leys" are generally found to contain glycerin, carbonate of soda or caustic soda, chloride of sodium, gelatin and albumen. One of the processes for recovering the glycerin which promises to be the most economical and the most successful begins with concentrating the liquor until the salts contained therein begin to crystallize. The liquid is then cooled and filtered to rid it of gelatin and albumen. It is afterwards made to absorb carbonic acid, which precipitates bi-carbonate of soda, and which is separated from the liquor in the usual way. After undergoing this process the liquor is then made to absorb gaseous hydrochloric acid until what remains of carbonate of soda has been converted into chloride, and further, until all, or almost all, the chloride of sodium has been precipitated and separated from the liquor in the usual manner. Arrived at this stage, the liquor contains water, glycerin and hydrochloric acid. The acid is then evaporated entirely and absorbed in water for using afresh. The dilute glycerin remaining can be purified by filtering it through animal charcoal or by concentrating and distilling it in the usual way.

AN INDUSTRIAL AND TECHNOLOGICAL MUSEUM. —An Industrial and Technological Museum of a very comprehensive character is in course of organization at Sydney. It is to include animal, vegetable and mineral produce in the crude and in the manufactured states: waste products, of whatsoever origin, foods with their constituents, and that necessary shadow side of the picture, their adulterations; educational appliances; sanitary apparatus and systems, models, plans, machinery, etc., for mining; agricultural machinery and manures; models, drawings, and descriptions of patents; a department of economic entomology; ethnological specimens, etc. One remark in the prospectus may call up a smile. The museum is intended to occupy a similar position to the South Kensington Museum. This might be construed to mean that it is to occupy a site as far out of the way of merchants, manufacturers, patentees, etc., as possible. We need scarcely say that the project has our best wishes.

METEOROLOGICAL REPORT FOR NEW YORK CITY FOR THE WEEK ENDING JULY 9, 1881.

Latitude 40° 45′ 58″; Longitude 73° 57′ 58″; height from ground, 53 feet; above the sea, 97 feet; by self-recording instruments.

JULY.	BAROMETER. MEAN FOR THE DAY. Reduced to Freezing.	BAROMETER. MAXIMUM. Reduced to Freezing.	BAROMETER. MAXIMUM. Time.	BAROMETER. MINIMUM. Reduced to Freezing.	BAROMETER. MINIMUM. Time.	THERMOMETERS. MEAN. Dry Bulb.	THERMOMETERS. MEAN. Wet Bulb.	THERMOMETERS. MAXIMUM. Dry Bulb.	THERMOMETERS. MAXIMUM. Time.	THERMOMETERS. MAXIMUM. Wet Bulb.	THERMOMETERS. MAXIMUM. Time.	THERMOMETERS. MINIMUM. Dry Bulb.	THERMOMETERS. MINIMUM. Time.	THERMOMETERS. MINIMUM. Wet Bulb.	THERMOMETERS. MINIMUM. Time.	MAXI'M In Sun.
Sunday, 3	29.974	30.100	0 a. m.	29.898	12 p. m.	77.3	67.3	87	5 p. m.	71	6 p. m.	65	5 a. m.	60	5 a. m.	139.
Monday, 4	29.861	29.898	0 a. m.	29.800	5 p. m.	71.6	67.6	85	1 p. m.	72	1 p. m.	70	5 a. m.	66	5 a. m.	136.
Tuesday, 5	29.850	29.906	9 a. m.	29.790	7 p. m.	77.3	70.7	85	5 p. m.	75	5 p. m.	68	3 a. m.	66	3 a. m.	138.
Wednesday, 6	29.828	29.902	12 p. m.	29.750	4 a. m.	82.7	75.0	88	4 p. m.	79	7 p. m.	74	5 a. m.	70	5 a. m.	147.
Thursday, 7	29.983	30.002	9 a. m.	29.892	12 p. m.	76.0	69.3	83	3 p. m.	71	3 p. m.	70	5 a. m.	68	5 a. m.	143.
Friday, 8	29.927	29.998	12 p. m.	29.836	6 a. m.	67.0	65.0	71	7 a. m.	69	7 a. m.	64	2 p. m.	63	2 p. m.	85.
Saturday, 9	30.059	30.090	12 p. m.	29.998	0 a. m.	70.3	66.6	80	4 p. m.	72	4 p. m.	63	6 a. m.	62	6 a. m.	140.

		Dry.	Wet.
Mean for the week	29.926 inches.	74.6 degrees	68.8 degrees.
Maximum for the week at 0 am., July 3rd	30.100 "	at 4 pm. 6th. 88. "	at 7 pm 6th, 79. "
Minimum " at 4 " 6th	29.750 "	" 6 am. 9th. 63. "	at 5 am 3rd, 60. "
Range	.350 "	" " 25. "	19. "

JULY.	WIND. DIRECTION. 7 a. m.	2 p. m.	9 p. m.	VELOCITY IN MILES. Distance for the Day.	FORCE IN LBS. PER SQR. FEET. Max.	Time.	HYGROMETER. FORCE OF VAPOR. 7 a. m.	2 p. m.	9 p. m.	RELATIVE HUMIDITY. 7 a. m.	2 p. m.	9 p. m.	CLOUDS. CLEAR, 0 OVERCAST, 10. 7 a. m	2 p. m.	9 p. m.	RAIN AND SNOW. DEPTH OF RAIN AND SNOW IN INCHES. Time of Beginning.	Time of Ending.	Duration. h. m.	Amount of water	OZONE. 0 10
Sunday, 3	w. s. w.	w. n.w.	w. s. w.	180	2½	1.20 pm	.416	.558	.585	69	49	55	2 cir.	2 cir. cu.	2 cu. s.	-----	-----	-----	--	4
Monday, 4	n. n. w.	e. n. e.	w.	104	4	6.30 pm	.581	.644	.654	72	85	85	3 cir. s.	9 cir. cu.	9 cu.	1.30 pm	7.15 pm	5.45	.80	0
Tuesday, 5	n. e.	s. s. e.	s. w.	94	2½	8.30 pm	.622	.650	.717	85	59	70	9 cu.	3 cir. cu.	5 cir. cu.	-----	-----	-----	--	2
Wednesday, 6	w.	n. n. e.	n. n. w.	141	2	2.40 pm	.690	.836	.773	70	65	71	0	4 cir. cu.	2 cir. cu.	5.00 pm	5.15 pm	0.15	.04	1
Thursday, 7	n. e.	s. e.	s. e.	180	3	2.00 pm	.641	.610	.631	76	56	80	2 cir.	3 cir. cu.	10	-----	-----	-----	--	0
Friday, 8	s. e.	e. n. e.	n. n. e.	202	6¾	11.40 am	.682	.562	.536	90	94	84	10	10	10	9.00 am	2.00 pm	5.00	.06	4
Saturday, 9	e. n. e.	s. s. e.	s. s. e.	102	1	4.00 pm	.529	.648	.622	89	73	85	9 cu.	7 cir. cu.	10	-----	-----	-----	--	0

Distance traveled during the weeek	1,003 miles.	Total amount of water for the week	90 inch.
Maximum force	6½ lbs.	Duration of rain	11 hours.

DANIEL DRAPER, PH. D.

Director Meteorological Observatory of the Department of Public Parks, New York.

WAR DEPARTMENT REPORTS.

METEORS OBSRRVED DURING MAY, 1881.

Almota, Wash. Ty., 18th. Boise City, 3d. Ft. Stevenson, 2d, very brilliant, observed about 8 p. m. in the southern heavens; first appeared about 5° above the horizon and inclined south and downward; its flight lasted about 5 seconds, leaving a faint train; in size, it was apparently nearly equal to that of the full moon. Fredericksburg, Tex., 22d, 10.10 p. m., altiude 45°, direction from northwest to southeast; as it passed along it gave a light much brighter than the stars, leaving a trail of dark blue color and exploded apparently into three balls of fire. Davenport, 22d. Washington, D. C., 9th, 9.45 p. m., appeared 45° above south eastern horizon, pursued a northwesterly course through zenith; extent of its visible path was about 20°. Wood's Holl, 3d, 2.10 a.m., from east to west. Woodstock, Md., 17th, 9 p. m.; 23d, 9 p. m., from southeast to northwest; 24th, 8 35 p. m., from west to east. Williamstown and Fall River, Mass., 13th. Thornville, Mich., 27th. Fayette, Miss., 1st. Atco, N. J., 22d, 24th, North Volney, N. Y., 23d. Waterburg, N. Y., 2d. Little Mountain, Ohio, 7th. Mission House, Wis., 2d.

Table of Maximum and Minimum Temperatures for May, 1881.

STATE OR TERRITORY.	SIGNAL SERVICE.			U. S. ARMY POST SURGEONS OR VOLUNTARY OBSERVERS.		
	Station.	Max.	Min.	Station.	Max.	Min.
Alabama	Montgomery	90°	58°	Auburn and Green Springs	---	56°
"	---	---	---	---	---	---
Arizona	Tucson	106°	---	Texas Hill	108°	---
"	Yuma	---	31°	---	---	---
Arkansas	Little Rock	87°	61°	Mt. Ida	88°	---
"	---	---	---	Fayetteville	---	48°
California	Visalia	95°	---	Turlock	109°	---
"	Campo	---	31°	Summit	---	30°
Colorado	Denver	84°	---	Hermosa	92°	---
"	Pike's Peak	---	5°	---	---	---
Connecticut	New London	89°	---	---	---	---
"	New Haven	---	36°	---	---	---
Dakota	Ft. Bennett	92°	28°	Ft. Buford	---	22°
"	Bismarck	---	28°	---	---	---
Delaware	Breakwater	82°	45°	Dover	90°	---
Dist. Columbia	Washington	95°	44°	---	---	---
Florida	Jacksonville	96°	63°	Ft. Barrancas	---	---
"	---	---	---	St. Augustine	---	---
"	---	---	---	and Houston	---	60°
Georgia	Augusta	98°	---	Forsyth	99°	---
"	Atlanta	---	52°	McPherson Bks	---	50°
Iowa	Dubuque	90°	---	Clinton	95°	35°
"	Davenport	---	38°	---	---	---
Idaho	Ft. Lapwai	88°	27°	---	---	---
"	Lewiston and					
"	Boise City	88°	---	---	---	---
Illinois	Springfield	88°	37°	Pecria and		
"	Chicago	88°	---	Elmira	93°	---
Indiana	Indianapolis	89°	44°	Logansport	99°	---
"	---	---	---	Spiceland	---	41°
Indian Territory	Fort Gibson	92°	---	---	---	---
" "	Fort Sill	---	56°	---	---	---
Kansas	Leavenworth	90°	43°	Independence	93°	---
"	---	---	---	Clay Centre	93°	40°
Kentucky	Louisville	93°	51°	---	---	---
Louisiana	Shreveport	92°	---	Pt. Pleasant	93°	---
"	New Orleans	---	60°	---	---	---
Maine	Portland	86°	---	Gardiner	---	27°
"	Eastport	---	32°	---	---	---
Maryland	Baltimore	95°	46°	Woodstock	---	38°
Massachusetts	Boston	91°	36°	Williamstown	---	25°
Michigan	Marquette	88°	25°	Hudson and		
"	Port Huron	88°	---	Litchfield	94°	---
"	---	---	---	Ft. Brady	---	24°
Minnesota	Moorhead	88°	---	New Ulm	89°	---
"	St. Vincent	---	28°	---	---	---
Mississippi	Vicksburg	94°	62°	---	---	---
Missouri	St. Louis	91°	43°	---	---	---
Montana	Fort Keogh	98°	---	---	---	---
"	Ft. Assinniboine					
"	& Rock Creek	---	20°	---	---	---
Nebraska	North Platte	88°	37°	Ft. Niobrara	96°	---
Nevada	Winnemucca	86°	28°	Carson City	94°	---
"	---	---	---	Palisade	---	25°
N. Hampshire	Mt. Washington	61°	8°	Contoocookville	88°	---
New Jersey	Sandy Hook	91°	---	South Amboy	97°	---
"	Barnegat	---	37°	Atco	---	32°
New Mexico	La Mesilla	101°	---	Ft. Union	---	28°
"	Sante Fe	---	33°	---	---	---
New York	New York City	93°	---	West Point	98°	---
"	Buffalo	---	32°	Madison B'ks	---	21°
North Carolina	Charlotte	94°	---	Weldon	96°	---
"	Fort Macon	---	50°	Murphy	---	43°
Ohio	Columbus	92°	---	Cincinnati	---	---
"	Cleveland	---	36°	Jacksonburg and		
"	---	---	---	Ruggles	96°	---
Oregon	Roseburg	85°	36°	Ft. Klamath	---	17°
Pennsylvania	Pittsburg	95°	38°	Milton	100°	---
"	---	---	---	Dyberry	---	21°
Rhode Island	Newport	85°	39°	Ft. Adams	---	35°
South Carolina	Charleston	91°	56°	Aiken	97°	53°
Tennessee	Knoxville	93°	49°	---	---	---
Texas	Rio Grande	102°	---	Ft. Ringgold	106°	---
"	Fort Davis	---	41°	Ft. Brown	---	36°
Utah	Salt Lake City	86°	40°	Promontory	91°	---
"	---	---	---	Kelton	---	30°
Vermont	Burlington	85°	30°	Charlotte	90°	---
"	---	---	---	Wookstock	---	23°
Virginia	Lynchburg	96°	---	Accotink	97°	---
"	Fort Myer	---	43°	Ft. Monroe	---	42°
Washington Ty	Almota	87°	---	---	---	---
"	Colfax	---	25°	---	---	---
West Virginia	Morgantown	85°	39°	Flemington	90°	---
Wisconsin	Madison	88°	35°	Beloit	91°	31°
"	Milwaukee	88°	---	---	---	---
Wyoming	Cheyenne	79°	32°	Ft. Fetterman	85°	16°
"	---	---	---	Ft. Bridger	---	---

SUN SPOTS.

The following record of observations made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C., to W. B. HAZEN, Brig. and Bv't Maj. Gen., Chief Signal Officer, U.S.A.

DATE, MAY, 1881.	No. of New		Disappeared by Solar Rotation.		Reappeared by Solar Rotation.		Total Number Visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
1, 9 a. m.	0	0	1	1	0	2	1	6	
5, 7 a. m.	4	9	0	0	-----	-----	5	15	
7, 9 a. m.	0	0	1	2	0	0	4	13	
8, 9 a. m.	0	5	0	0	0	0	4	18	
5 p. m.	0	7	0	0	0	0	4	25	Many of the spots small.
9, 8 a. m.	0	0	0	0	0	0	4	18	
10, 9 a. m.	1	3	0	3	1	3	5	18	
11, 9 a. m.	0	7	1	4	0	7	3	17	
12, 9 a. m.	1	10	1	2	1	10	2	20†	
13, 8 a. m.	1	2	0	0	1	2	3	22†	
14, 8 a. m.	0	0	0	0	0	0	3	13†	
15, 9 a. m.	0	0	0	0	0	0	2	8	
16, 12 m.	2	5	0	0	1	2	4	8	
22, 10 a. m.	0	0	0	0	0	0	3	9	
23, 8 a. m.	1	5	0	0	0	0	4	16	
24, 6 a. m.	0	10	0	0	0	0	4	26†	
25, 8 a. m.	0	10	2	6	0	0	2	30†	
26, 6 a. m.	1	7	0	0	1	7	3	37†	
27, 8 a. m.	1	7	0	0	0	6	4	44†	Many of the spots small.
28, 8 a. m.	0	12	0	0	0	12	4	56†	
29, 9 a. m.	0	0	0	8	0	0	4	48†	
30, 8 a. m.	2	15†	0	7	1	1	6	60†	
31, 7 a. m.	0	10	0	5	0	4	5	65†	Faculæ were seen at the time of every observation.

†Approximated.